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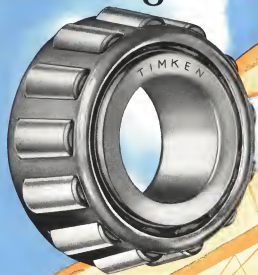
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AVIATION

The Oldest American Aeronautical Magazine

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Contents for August, 1932

Volume 11, Number 8

Transport airplanes, then and now *By Edward P. Warner* 325

Answers to transport's problems 328

Decentralized overhead for constant-speed service *By J. Paul Johnston* 332

Seven modern transport interiors 336

How many engines? *By Capt. Frank T. Courtney* 337

What war, air transport? *By Edward P. Warner* 340

What's what on the airlines 344

Dividing up the airline dollar 348

Voices from the heavens 349

Blind flying and the airlines 349

Combating ice formation with heat *By William D. Gies* 353

Visiting Japan 359

EDITORIAL 361

ADVERTISING 361

LAST YEAR 361

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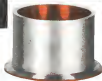


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CONTENTS

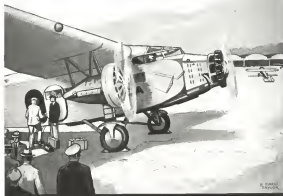
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Transport airplanes, then and now

By Edward P. Warner

THE American people conceived the World War the possession of an improved field position, a strong suspicion of all things European, and several thousand DII-4 airplanes. The DII-4 are still very much present, the DII-4 are gone but before they disappeared they had had a mighty effect on the development of American aviation, and in military and in commercial aviation.

The earliest American air transport equipment derived directly from a military root. The air mail was first operated, somewhat unsatisfactorily, with Curtiss JN's. As the service began to be taken more seriously, and the load increased, existing ships proved inadequate and the Army's observation type was substituted. When the initial operation of the mail service was taken over by the Post Office Department from the War Department, a substantial number of DII-4s were taken over with it. From such humble beginnings have grown the magnificent air fleets of today.

There are two objectives in the design of a transport airplane—safety, economy, comfort, reliability and speed. In the early air mail planes, economy played practically no part at all, and speed played a distinctly minor one. Comfort for the pilot was borne in mind in laying out the cockpit, but it was a matter to be considered only as an end in itself. The great objectives were safety and reliability of service, and safety was judged with reference to the pilot alone. For passenger accommodation had not even been dreamed of. There were attempts at building passenger planes in the years immediately after the war but none of them were built in any great

numbers, and most of them had much influence on later-day developments. The mail was the only cargo, and it was the pilot's job to put the mail through if there was the slightest chance of success.

When the sailing ship came to sea, or when rolling clouds trapped the pilot in a pass in the atmosphere, a crash was all in the day's work. The remark of one of the DII-4 men, describing the unceremonious way of the transition to a mail route that there was a landing place for DII-4s, but there are no pretty good places to crash up in" was typical of the time. That observation, and others like it, go far to explain some of the characteristics sought in the reconstruction of the DII-4 and in other airplanes designed purely for mail-carrying up to the present day.

The search for mail planes

Two years are less all the calendar it is the summer of 1916. Privately operated air transport, so far confined to a few experiments on an almost tiny scale is about to be launched on a broad front. The War Air Mail Act has just taken effect and five contracts have been awarded scattered across the country from Boston to Los Angeles and Seattle. At the same time Mr. Thomas Miles, manager of Philadelphia's rapid transit, has taken up a new activity. Having just returned from Europe and greatly impressed with European transport operations, he prepares to launch the P. R. T. Air Service between Philadelphia and Washington.

As the officials of the first companies to take mail contracts looked about for equipment, they found it principally in new planes. First, there were the Douglas Mailplane and the Curtiss

Carrier Pigeon, the former based on the Douglas Army observation plane and the latter completely independent of military design, originally developed to be offered to the Post Office Department in the spring of 1923. Both were bi-planes, and both conformed in a general way to the specifications that had been written around the air mail DII-4, but modified to provide for a larger pay load (1,000 lb.) and a higher cruising speed (180 m.p.h.). They were designed for pure mail service with no thought of passenger carrying.

In the second place, there were already available a few passenger transport airplanes from American sources. The Ford Motor Co. had taken over the development work initiated by William B. Hand some years earlier, and had produced the first three-seater Ford with V-8 engine, in the early spring of 1916. The motor Fokkers had been imported from the Dutch Fokker factory for demonstration, and a purely American Fokker transport had been put on the market as the Universal, weighing a single V-8 engine and equipped for five passengers.

It was left to Mr. Miles and his associates to inaugurate the first truly extensive passenger operations in the United States with mail planes. Miles had conceived his enthusiasm for air transport in Europe, and it was to Europe that he turned for his inspiration and for key personnel. From President director of the K. L. M., he took the advice to use Fokker airplanes, and in 1916 Fokkers were reported from Holland for the Philadelphia-Washington service, which opened in July, 1916. From President, also, Miles took a key member of his organiza-

ation in the person of Victor Frieser who came to America to assist operations on the P-10. Later, he was installed over some operations managers of Pan American Airways.

The 1927 outlook

In the summer of 1926, in short order, four or five American factories had shown the slightest interest in building transport planes, and each of them had had a single design or two at most to offer. Later another year and a half of the calendar. Lockheed has been in the air since 1917 and, as yet, no one in America had ever made, and Ford has done it with three. Public enthusiasm for aeroplanes has established as all-time highs both in volume and in lack of discrimination. The sweep of passenger, good, bad and indifferent, has not yet assuaged the proponents of a third wave, but the items that will cut it in sections are gathering below the surface. The volume of transport operation is still insignificant. The total passenger traffic for the year 1927 was about equal to the number that was made in a single week in the summer of 1932 and the daily revenue figure was but 10,000, against 150,000 four years later. But things are moving on. The transcontinental era will have been tamed over to private operation. A dozen new airlines have been hit, and there has been one very important addition to the list of airline manufacturers who have begun to think that there may be something in this transport business. In finding the answer, the designer has created a new type.

When the transcontinental route was opened to private building, in two sections, the line out to the Chicago San Francisco portion came from Messrs W. K. and Edward Hubbard. The contract went to Republic Air Transport, and the Boeing Airplane Company's latest was to work. The Model 40 came through as the first, straight airplane in which the designer had taken some preparations for handling passengers had been taken into account.

Military and nonmilitary builders

At the end of 1929, it was already plain that the manufacturers of transport planes were to divide sharply into two groups, and that their design practices were to show a correspondingly sharp division. On the one hand came the makers of military planes—Boeing, Curtiss and Douglas—and their products

were, essentially, slow to the military end of the hour. The other school was essentially civilian. Only a few military specialists represented were Ford, offering the first American-built commercial plane with all-wheel struts, and Fisher. They followed the trend, earlier displayed in Continental Europe, towards cantilever or semi-cantilever construction. The Traveler Company, another nonmilitary manufacturer, also took to the nonmilitary when a design was to be brought out for specialized transport service. The only really sharp break in the grouping was given by Pitcairn and Shreve, purely non-military companies which nevertheless stuck to cantilevered airplanes in developing the "Pitcairns" and "Shreves" and new-type ships, however, which have given load and constant service on cargo lines, took these technical security lines from the early three-seaters then from any military products.

The latter part of 1927 brought forth another reported success, in addition to the Boeing 48. Earp's venture had been built up about exclusively around passenger investment. In Arizona, on the whole, the passenger had been at short-hand, and not a particularly welcome one. The Western Air Corporation had determined that at least one aircraft should be made under ideal aspect, virtually freed from immediate financial pressure, and permitting the use of the most convenient and useful material that could be found.

The line between San Francisco and Los Angeles was selected as most promising. Western Air Express became the immediate recipient of a loan, the Ford company became the absolute beneficiary of the resulting order.

The Foster P-16, the first examples of which were built for order at Western Air and purchased with the Government loan was the first manifestation of tendencies which have in the past few years been considered as characteristically American. It was the first American passenger plane of very high power and very high speed, and it was the first American passenger plane to be equipped with a 500 hp per passenger unit to drive at 120 mph. Other orders included capital and

rebated into the market. Some seven of the P-17s were built in all as the means of two orders. Only a few months later, the first of the West-exposed Boeing appeared, and for them, too, there was a general demand which has built the total production of the model up to about 500 up to the present time.

High spots of development

Nineteen twenty-eight was the end of the great financing boom, brought into line. In one respect air transport practice had marched more rapidly than military design in effecting a revolution. As early as 1925, it had become standard practice to use all-wheel or ground and air-cushion support about a transport plane. The Wrights, Wrights and the Wags had divided the responsibility and the heaviest of the power units. The first modern tendency to give favor the liquid-cooled power plants which had been seen in the Liberty-engineered Curtiss Pitcairn and Douglas, was made in 1929 in the Curtiss Condor.

The Condor had other claims to fame. It was among the largest of commercial machines. It was America's first twin-engine transport since 1925. It was remarkable for comparatively light wing loading and low landing speed and it was a challenge to the popular theory that high cruising speeds were only to be had with monoplanes.

Less than nine months after the Condor's first appearance came the Foster P-32, with four Havoc engines, weighing 2100 hp, and with a carrying capacity completely exceeding all its predecessors. The first P-32 met with success, but several of its successors went into service between Los Angeles and San Francisco.

While the first P-32s were building, short legs a better one was developed, the properly domestic passenger biplane. Nothing less than 20 passengers seemed worth considering

At bottom, left, The Boeing 48, a certified two passenger unit, in flight. The airplane carried on below. The Government ordered this the next of two.



Above, Curtiss Condor and below, Douglas Western Airplane, 1929. Three Havoc units.

Below, The first American passenger plane, the Lockheed Explorer (1927). Right, The P-16 (1929).



The Boeing tri-engine was ready for service along with the P-32, the Condor and the Keystone Patroline, and the Ford Company's engineering staff began design studies for larger

In the last couple of years there has been a revolution, away from immediate use in a recognized design, transport planes have their place, and they are designed and built in limited quantities for special service, but it is nearly clear that commercial air transport is on its way, and that under present conditions, a joint study route can be made effectively served by airplanes of comparatively modest dimensions. A majority of the new transport types developed since the beginning of 1929 percent of pay loads of approximately 3,500 and 2,500 lb., and have come between 400 and 1,000 hp.

Factor! Factor!!

The demand for better airplanes was one of the two basic ones of 1929, and it has been met. The other aspect of the year still hangs at heady in view. It provides the steel for mass speed.

Most characteristic of the difference between American and European air transport has been the contrast between the widespread open speed and ever more in America and the comparative indifference with which extremely high speed has in the whole been regarded in Europe. It is rather even, as a matter of fact, that the European passenger line has been concerned in recent times with cruising speeds around 100 mph, and that so far there has been a demand for much higher velocities in



the old world it has been occurred especially with long-distance mail planes, whereas in America the demand for speed never became really vocal and instead passenger transport had begun to play a large part.

In 1926, the typical mail plane cruised at about 90 mph. By 1929 it had been dropped up to about 110, either with mail or with passengers. Nineteen thirty-one saw the first entry into trans-Atlantic service of super-speed ships, the Lockheed Vega and Orion and the Boeing Monomail. Nineteen thirty-two brought additional to their list in the Consolidated Pioneer. In each member of which had been purchased two years earlier by N.Y.R.A., and the new Boeing bi-engine transport, almost to go to general service on United Air Lines. All the machines mentioned by name in cruising speeds of 140 mph or better, and during the past year the latter has been well-served in passenger traffic that at least 275 mph. will soon be normal, with 200 mph not far behind.

Although the high-speed transports are so enthusiastic as over on this point, still there are some signs of diffusion in the ranks. There are a few specialists and a few enthusiasts, and as the whole their number is probably a little larger now than it was a year ago, who are beginning to doubt the comparative importance of high-speed speed and who feel that present speed levels ought to be accepted as satisfactory in order that more attention may be devoted to engine records in economy and in passenger comfort and that landing speeds may be brought down. Landing speeds still tend upward, and they are now about 100 to 115 per cent, and the average, between 1927 and 1930. The talk here has been exclusively

a long while after the suspension of transatlantic operations, and when this came back it was in the same neighborhood where they had made their commercial debut. Passenger transport in flying boats and airplanes again became a focus where Pan American Airways started their operations in the Caribbean and New York. Rio de Janeiro, Santos, Lima opened up further to the south. Almost all the Latin-American routes deferred, machines equipped by its owner, and many of them specifically required amphibious. The 50-tonnage machine have worked with Pan American for more than three years, modifying their designs to accommodate the lessons learned from operating experience. Pan American has bought no airplanes or amphibians directly from any other source. Co-operative rather than competitive, the development began with the 6-passenger S-36 and shows its latest stage in the 14-passenger S-40. Since 45,000 lbs. of gross take-off weight, 30 of that goes into the service of Pan American Airways.

Flying boats without amphibious gear were the nucleus of N.Y.R.A.'s fleet, and they were taken over by Pan American. They were manufactured Consolidated, based on the first Consolidated had turned out for the Navy in 1926, the first large amphibious flying boat in the United States. The Consolidated was remarkable for passenger capacity, showing a pay load of almost 8 lb. per horsepower as against the 3 lb. or less that has been almost at handlands in recent years.

The 1932 idea

The production of transport planes in 1930 and 1931 was very small, except in one or two models looked to operate on new lines such as the Stinson on the Atlantic coast at 15 per cent, and the Lockheed of Brown and Verme, for the latter had turned-out an over-



simply in the previous year. New designs at the post-war years have had to be considered largely as experimental or as speculative ventures. The post-war has been reached, however, where much of the experiment in hand will no longer serve, where replacement patterns must be made in substantial numbers, where it is of great interest and importance to try to reap the greatest benefit at design prices.

Comparing the equipment of 1938 with that of 1932 on a whole the tendency to standardization is manifest. Both the great planes and the very small ones have needed into a minor role, called upon for highly specialized service, and capacities of from 6 to 10 passengers capacity are becoming more and more prevalent. The tri-motor business, about 50 of which were in transport service in 1930 and 1931, fully represented the idea of moderate capacity, permitting very frequent service, coupled with local power per passenger and low cost.

Clearly the trend swings toward the monoplane. Even the lightest, the tri-motor, obviously is a winner. Clearly it swings toward all-metal construction, especially for fast planes. Until 1939 Ford was slow in adopting the metal construction but since then



its Hamilton the Monowheel and the Fletcher have made slow appearance. Equally clear is the movement in increased capacity like the newer quality and is, certainly of 1932, part of the structure.



and all the accessories. The subject of maintenance specifications, treated by Mr. Lockwood in two recent articles in AVIATION, has become a very live issue indeed.

It is a little difficult to set figures on the trend in speed, in view of the popular demand that they be increased with age. Generally speaking, however, a cruising speed of 180 m.p.h., or better, seems to be typical of the steady present-day designs, and if the general importance on the pre-war era of speed continues undisturbed that figure ought to be increased about another 15 m.p.h. in the course of the next two

years. Even in recent designs in which there has been a secondary factor, the cruising figures have been kept up to 112-125 m.p.h. Concentration on high speed is having at least one wholly desirable effect in forcing the closest attention to streamlining in aerodynamic detail. No longer do we see the most casual diagram figure that "it won't matter if it is not being struck into the air-stream." A particular manifestation of the streamlining process has been the rapidly growing popularity of retractable landing gear. They bring a variety of mechanical problems with them, they are slow to retract completely and in production cost, they give the pilot something else to think about, but they are paid for by an 18 m.p.h. increase in speed on any low-wing monoplane and on



Above: Stearman used for post-war training and the low-wing Lockheed. Below: Pre-war design in the Boeing Stearman, tri-motor and low-wing. The tri-motor Stearman.

AVIATION

April, 1932

and 1939 were the great years of the tri-motor.

The year which followed showed the dawn of a new floor for single engines, at least where weather conditions and terrain were good, and in 1931, the position of the plane with a single power unit was further strengthened with the introduction of the Lycoming and Northrop Alpha, the offering of the Bellanca Aerobat (the largest single-engine transport ship at the world), and the putting into service of a considerable number of Lockheeds. To be sure, however, it took years the number of new Stearman tri-motors taken into

a much earlier period than did the American lines. On the other hand the old world, with very recently, gave relatively little attention to increase of speed. The British have been particularly addicted to large airplanes of moderate speed. Of the twenty airlines in the presence of several American services, seventeen have a gross weight at 15,000 lb. or more, and not one carries at all as much as 100 m.p.h. The very largest, the Handley Page 42 carries 38 passengers and weighs 29,000 lb. A typical British plane, the Armstrong Whitworth, with total power approximately equal to the five Boeings of a Ford or Fokker or the two Composites or the Cessna Courier, shows a gross weight of 10,000 lb. as against the 16,000 of the Conqueror and the 14,000 of the largest ship-carrying plane, the Avrocar, however, carries at only 10,000 lb. while the American ships show 130 or better.

The British Air Ministry has definitely become much excited over speed, however, and just a few months ago placed an order with Boulton Paul for a bi-plane road courier to cruise at 120 m.p.h. in all of Europe there are only 348 transport machines, or a little less than one-third of the total is service that are capable of cruising at over 100 m.p.h., and only six that can land 100. The latest Fokker on K.L.M. with three Wasp engines, cruises at 124 m.p.h. No exactly corresponding figure can be given for the United States, but certainly at least 50 per cent of our transport will have cruising speeds of over 120 m.p.h.

European trends in Aviation

Although the special case here has been to review the developments of American air transport, the subject ought not to be left without some attention to the relations of American and European practice. On the whole, the two continents have followed distinct lines, and have been relatively little attracted to each other. Europe, looking on passenger transport, went in for very large airplanes, for multiple engines, and for slow but comfortable accommodations at

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The year which followed showed the dawn of a new floor for single engines, at least where weather conditions and terrain were good, and in 1931, the position of the plane with a single power unit was further strengthened with the introduction of the Lycoming and Northrop Alpha, the offering of the Bellanca Aerobat (the largest single-engine transport ship at the world), and the putting into service of a considerable number of Lockheeds. To be sure, however, it took years the number of new Stearman tri-motors taken into

a much earlier period than did the American lines. On the other hand the old world, with very recently, gave relatively little attention to increase of speed. The British have been particularly addicted to large airplanes of moderate speed. Of the twenty airlines in the presence of several American services, seventeen have a gross weight at 15,000 lb. or more, and not one carries at all as much as 100 m.p.h. The very largest, the Handley Page 42 carries 38 passengers and weighs 29,000 lb. A typical British plane, the Armstrong Whitworth, with total power approximately equal to the five Boeings of a Ford or Fokker or the two Composites or the Cessna Courier, shows a gross weight of 10,000 lb. as against the 16,000 of the Conqueror and the 14,000 of the largest ship-carrying plane, the Avrocar, however, carries at only 10,000 lb. while the American ships show 130 or better.

The British Air Ministry has definitely become much excited over speed, however, and just a few months ago placed an order with Boulton Paul for a bi-plane road courier to cruise at 120 m.p.h. in all of Europe there are only 348 transport machines, or a little less than one-third of the total is service that are capable of cruising at over 100 m.p.h., and only six that can land 100. The latest Fokker on K.L.M. with three Wasp engines, cruises at 124 m.p.h. No exactly corresponding figure can be given for the United States, but certainly at least 50 per cent of our transport will have cruising speeds of over 120 m.p.h.

Although there is more air-line operation in America than in all Europe, American lines are only about 600 planes (841 at the beginning of 1932, as shown in the statistical index of AVIATION), against 285 in Europe according to the latest count. France and Germany are far more than two-thirds of the total number of European ships. The French are particularly prodigal of engines, the average airplane carries daily for about 100 passengers, there being only 37, as against 202 for



Big Airlines. Above: KLM's Conqueror. Below: Lockheed's Alpha. Middle: Handley Page's 42. Right: Boeing's 4-D. Below: Boeing's 4-D. Below: Boeing's 4-D.

Below: Boeing's 4-D. Below: Boeing's 4-D. Below: Boeing's 4-D.

average American practice. American airplanes are more heavily by experience some of the lessons about passenger accommodations that have been learned upon European air

service that we have learned very rapidly, and at the present time it is quite safe to say that the quality of recently built transport equipment in America is better than that from the factories of any other country in the world.

—W. H. Harrison, our correspondent in the Dutch Indies.

The demand for greater reliability and increased maintenance has caused the European market for American engines and accessories to be in a very active state. The fact that American engines are being installed in European aircraft is a very good indication of the confidence in American engines. The fact that American engines are being installed in European aircraft is a very good indication of the confidence in American engines. The fact that American engines are being installed in European aircraft is a very good indication of the confidence in American engines.

—W. H. Harrison, our correspondent in the Dutch Indies.



Upper left: The steel seat in the row has been materially reduced in the latest version of the three-cabin transport. Middle: Forward section and conversion and an overhead view are included in the latest Model E, two-engine design. Left: Section showing the layout of seats for the airplane floor characteristics the lack of use of the centrally mounted floor plates. Right: A full interior including an unusually designed aisle, refrigerator cooling duct, and window with sun protection on the front (lower) side. Below: A seating layout proposed for airplanes not limited to other services, where passengers are accommodated in the British Air Line.



Right: Four three seats are included in the British version of the Model E, two-engine design. The view in the lower left shows the latest Model E, designed for British Air Line.

Comfort, efficiency, and appearance

Seven modern transport interiors

How many of these operators' arguments on power-plant subdivision are based on accurate analysis of the question? How many participants in these debates have really made a serious study of the many factors involved in the problem? For those who have not, and also for those who have, it would be well worth while to follow through the investigation made by Captain Courtney, based on long experience and close association with the co-ordination of transport operation and design.

How many engines?

By Capt. Frank T. Courtney

THE position of using only one engine is very much under discussion at the present time. For purposes of this discussion we may suggest that as usual that only one engine is practically possible. Mail planes of the past were in this category, and led to a technique and conception of operation which have penetrated into the quite different field of passenger travel. We may assume that all future transport planes could divide their power into two or more units if so required.

For the single-engine plane are claimed advantages in cost, maintenance, load carrying and speed over the multi-engine ship, with consequent increased economy of operation. It is important to estimate whether it has these advantages, and if so, whether they are engineering or aerodynamic advantages inherent in the use of one power unit, or whether they are incidental of

advantages obtained at the expense of something else.

In the single-engine plane there is only one engine unit, with only one set of controls, lines and instruments to install and maintain, and these are more likely to be easily accessible. It seems certain that this will reduce the cost of design and construction. As to maintenance, however, the advantage may not be overwhelming. Elementary figures might tend to show that the larger engine will not less per horsepower to overhaul and maintain, for example, the 600-hp. model has only the same size cylinders, with corresponding numbers of valves, plugs and connections as its small 300-hp. brother. On the other hand, the lighter the plane, the more refined and delicate the engine is likely to be, and in justice it seems to be working out that overheads are more frequent and costly. What definite advantages there is, therefore, seems to run mainly in the direction of economies.

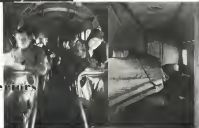
As to speed, the single engine will have less resistance per horsepower than two smaller quality engines of equal total power. This is because, other things being equal, the cross-sectional area which governs air-drag does not increase as rapidly as cylinder volume which governs power. But, partly offset in the case of transport planes, the advantage here is not great. It may easily be negative since much of the resistance of two smaller engines might be compensated with that of other parts of the structure, whereas the single engine must necessarily have a large body in the propeller. In other words, experience is in design may well lead to the two-engine plane having less resistance than the single-engine type. Recent engine design is heading in that direction.

In actual fact, however, the single-engine ship is slower than the multi-engine variety. It fell advantage in value of its higher load-carrying capacity, as we shall see when we come

to look into that aspect of the matter. Why, then, are single-engine planes employed for these extremely high training speeds on some airlines? Such planes are mostly of a type in which the passengers are closely crowded into a cabin of little more clearance than the first of the engine wing leading in very high, which not only means a high landing speed, but causes general discomfort to be so small as to practically prohibit the use of more than one engine. By the use of a wing column behind the engine, not only resistance is saved, but also the weight involved by using passengers open and equipment, by high wing leading both wing weight and wing resistance are saved. The speed might largely, therefore, mean the sacrifice of passenger space and comfort. In most recent planes, where speed and comfort have been associated, cruising speeds have come down considerably.

As to load carrying, the single-engine ship has definite advantages. Accidents contribute to this in some extent, reduced propellers, propellers are disproportionately heavy with the smaller engine, and it should be possible to estimate this situation to some degree. But for the most, the advantage for the single engine is not that it can carry larger loads, but that in circumstances normal it is so. The illustration points, let us take the 2,200 hp. version in most of our large transport planes today. The two-engine plane must be able to do with one engine stopped, so that it must be sufficiently lightly loaded so it, with 600 hp. The three-engine ship will, however, have 800 hp. left after the failure of one engine, and can load still more lightly. The single-engine aircraft has no horsepower left after the failure of one engine, and the question of carrying in flight does not arise if it can load in flight as other circumstances permit.

Taking these figures still further we can see that the two-engine plane, with



Where do we go from here?

What way, air transport?

By Edward P. Warner

WHERE will transport fly in three years from now or, ten? Will its principal patronage be derived from transcontinental passengers, or from those using only a couple of hundred miles? Will commuters hurry daily to the airport to catch the 2:16 from Los Angeles to Tulsa Springs, or the 12:21 from New York to New-Jerseyville, or the 5:47 from Chicago to the Northern Pecosville of Michigan? How much, if at all, will it save be cut? How much, if at all, will speed be increased? What else will happen? In short, in paraphrase of the famous observation of the backwoodsmen looking for the first time upon a waterplane crowd, "What we all got, and what we got to get to?"

The possibilities of air transport are infinite. At least a thousand different fields of application have been suggested in the past ten years. They range from organizing special services for jutting passengers on board liners at sea to the misuse of speed types of refrigerated aircraft to be used exclusively in delivering frozen fish and flowers. Many of them have already been put into practical effect, at least in a small way. DeWitt, and one of the most important among them, deserves only to be sketched with the next epoch which Calves Coolidge once bestowed upon an eloquently extemporaneous proposition: "Swamp work." Even unconnected experiments, however, lead at times to spectacular openings of an unknown order. Lord Tennyson Devere, whose mastery is still cherished in New England after many years as one of the most successful characters in the Yankee hierarchy, made a substantial addition to his fortune by shipping warming pots to the West Indies. The simple bludge of Jernstedt had no need for warming pots and no idea what they were, but found them exactly the instruments required for boiling molasses. When the next generation looks back on the development of air transport, no doubt they will find evidence of epiphany almost as whimsical as that one. It is as unwhispered to broad and so correct in possibilities as the carrying of men and merchandise by air we must approach every suggestion, even though it seems absurd upon the surface, with

an open mind. We may reject a good many of the proposals, but others we do so without a sympathetic examination. It is generally recognized that airplanes at sea would be subject to the law of gravity. It is equally true that their operations are subject to economic law. They have required neither the cost nor the effort of Mr. Stout's experimental craft that "a commercial airplane is one which is self-sustaining economically as well as spontaneously." Is the first lesson in the book. The one fundamental specification that every air transport operation or every type of air transport society must meet is the one requirement that transcends all others, is that somebody that be found who is willing to pay the bill.

Commencing by air

Let's see what that means. Take a look at a much-dimmed type of operation. There has been a great deal of talk for a number of years about commencing airmail by air. One of New York's greatest real-estate operators recently issued a public notice of a commencing one of four times the present distance, with people coming to work in airplanes each morning. "Swamp work" is to be done. The delights of life in the open country were to be brought within the reach of a great proportion of the workers in a city of 12,000,000 people. Incidentally, though the reader didn't dwell on this point, such a state of affairs would mean a good deal of passenger traffic of 25,000,000,000 passengers a year, or, averaging across around New York alone—more than the present total passenger business of all the rail road lines in the United States.

Incidentally, it makes a beautiful picture that new route with a little cheer and look at the details. Allowing that we shall be able, in due course to cut rates to 4 cents a mile and show a profit, the line-distance rounder on the economical five-mile would have to write down \$2,500 to \$2,500 in the family budget each year for commutation tickets.

These are, of course, people who can spend such sums without distress. There are New Yorkers who commute by public every day during the summer,

at an operating cost of \$26 a day or more, but don't do it for a single month in any one place to enjoy much of an office. They are measured not by men of thousands, but by scores or hundreds at most. There are, however, reasonable people who will wish they could live well out of the city and come to by air every morning, but most of them just won't be able to afford it.

Commencing is a type of operation which holds very limited prospects. Let's look at something more interesting. Consider a field, in which the airplane's success was assured even before it started, and in which air transport absolutely cannot fail.

There is at least one type of transport service about which there is no argument, because the airplane has no competitors. Until the airplane became available, service did not exist. Upon the waste spaces of the world, upon the deserts that have never been irrigated, the jungles that have never been cleared, and the swamps that have never been drained, there was no transportation in any modern sense until the airplane was introduced. Air travel could be too true as discomfiting as it is, and twenty times as disagreeable, and twice as expensive, and still there would be a sure and insatiable demand for it in Africa and tropical America. A friend recently returned from Central America writes: "These countries have joined with a single head from the coast to the interior. There are Indians to whom the daily passage of airplanes has become a commonplace incident, but who never have seen a railroad trestle or an automobile in their lives." Assume that we are bound to have air transport, on any terms.

Over the trackless air

Almost equally favorable are the opportunities over large bodies of water, where the only competition is with fourteen-knot steamers. Obviously one of the fundamentals of the future of air transport is its competition to the limit of every such opening. Air passenger traffic on the American Continent in the past year totalled about 1,800,000 passenger-miles in overland routes, where there is an effective railroad competition, and about 3,800,000 passenger-miles on over-open-water courses.

These figures are, I firmly believe, multiplied by ten within the next eight years. There are many opportunities yet untapped, perhaps the most important ones being the passenger and mail service between New York and Bermuda. Three years ago the maximum of regular service over 200 miles of open water would have seemed a fantastic project, but Pan American Airways has been running regularly for considerably more than a year on a route almost as long—that between Jamaica and the Canal Zone—and the land-connection methods that have been developed in the Caribbean would work equally well across the Gulf Stream.

Duration of the Bermuda route raises the question of security in a very interesting form. Air transport facilities have been discussed from many points of view, and primarily upon the assumption that they will probably be extinguished as representing economy of the nation makes the operation independent of government support. As a general principle they should, but there are some cases in which a subsidy can pay properly be expected to continue forever, and the business seems to be a possible example. One of the great difficulties in inducing American business men down to Bermuda lies in their knowledge that if any emergency arises requiring their presence on the scene of action it will take them two days and nights to get back. If they knew that they could make it in one hour, many of them would take to advantage of the opportunity. They might always travel by ship, but the knowledge that the airplane was there, if they ever needed it would move many men to take the trip who would never think of doing so otherwise. Though seaward on such routes it is difficult to see how, supposing if the existence of an airline to the islands, bringing mail to the United States, and carrying passengers is a small expense, were not worth a million dollars a year in added in-

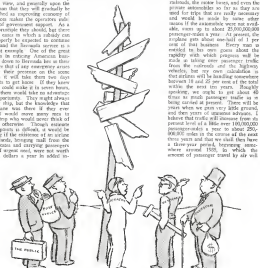
crease to Bermuda's hotels and shops. On such a route the local hotel association could well afford a permanent dock already of a cost a mile on 200 road trips a year.

The case of Bermuda is a reminder of the fact that all air traffic, particularly passenger traffic, leads to a larger coast mail and express business also, can be divided into two classes. There is the traffic that is taken away from a competing form of transportation, and there is that which would not exist at all if it were not for the air. Where transportation was extremely difficult or extremely slow before the airplane altered the dimension of newly created traffic is going to be a very important one. I believe that in parts of South and Central America and northwestern Canada and Alaska

it will run as high as 75 per cent within the next four or five years. In other words, three-quarters of the passengers will be people who would not have made the trip at all unless they had been able to make it by air. On airlines in the continental United States, an entirely different condition exists. The proportion of newly created business probably is not over 15 per cent. Those who go from New York to Chicago by air would be going by some other means if there were no airline, is the vast majority of passengers. That makes it comparatively easy to estimate the volume of traffic that we may look forward to on our domestic airlines.

Passengers in prospect

The total volume of American passenger travel on trips of 100 miles or more in 1928, taking into account the railroads, the water lines, and even the private automobiles so far as they are used for trips that are really necessary and would be made by some other means if the automobile were not available, came up to about 25,000,000,000 passenger-miles a year. At present, the airplane gets about one-third of 1 per cent of total business. Every man is needed to be on guard about the rapidly with which progress will be made in taking over passenger traffic from the railroads and the highway vehicles, but my own calculation is that airlines will be handling somewhere between 10 and 25 per cent of the total within the next ten years. Roughly speaking, we ought to get about 40 times as much passenger traffic as is being carried at present. There will be years when we aren't very little ground, and then years of unusual advance. I believe that traffic will increase from its present level of a little over 100,000,000 passenger-miles a year to about 250,000,000 miles in the course of the next three years and that we shall then have a three-year period, beginning somewhere around 1935, in which the amount of passenger travel by air will



[illegible]

MAP 1	
Solid Box	Intervene Always
Long Dash Box	Monitor At Pasture
Short Dash Box	Monitor At Transport
Dotted Box	Notify State Agency

MAP 1
 BOLD Inc. (a/k/a AB Group)
 Long Beach Bar Transcommunications & Western Air
 Dotted Bar Transcommunications AB-Base Corporation

MAP 1
Redd Sea: For American Airways
Black Sea: For American-Croat

avoids—every one for himself—pilot begins to disappear.

Severely restricted

In June, 1938, the Air Corps introduced blind flying instruction as a regular part of its training course at Kelly Field, and subsequently required blind flying training of all Air Corps pilots. The work of May W. C. Ocker and Lorel C. J. Crane has been outstanding in the study of the survival and recovery reactions of pilots when flying without the usual visual references. It was they who first clearly and systematically outlined the utter unreliability of the so-called "instinctive" flying. Major Ocker had been giving special thought to the problem since 1928. His stored actual experience in 1929, using a wheeled chair and a portable box open at one end and containing to the other a turn and bank indicator. Without looking into the box at the end of a rotation of the chair

to—none were entirely successful, but by keeping his face in the box and interpreting the turn and bank indicator he could control his reactions correctly provided he could persuade himself to believe the instruments and disregard his feelings. Pan American Airways has a similar device to convince pilots of the value of instruments.

Modern instruments include (1) aids to aviation, which are dependent upon ground broadcasting systems, such as the radio range beacon, and (2) aids to the control of the plane in all attitudes of flight. Instrument flying relies primarily to the interpretation of the second group. They, in turn, are of two types—outside instruments and charge-of-attitude instruments or aids—usually, instruments of the artificial horizon type and those of the turn indicator type. The former is best represented in this country by the Sperry horizon and deviation gnos, the latter by the Pioneer instruments. Each group consists of at least two parts. The turn and bank indicator must be supplemented by the attitude indicator, which the horizon should be

implemented by the directional gyro, though a compass may be used instead. Research is going rapidly forward in the development of a single instrument which will indicate the plane's attitude with respect to all three axes, such as the Ocker-Crane Flight Integrator. Such a device will indicate blind flying easier and more positive. The Lupton Air-T-Ran, notable for its extreme simplicity, also falls into the category of attitude instruments.

The artificial horizon is fundamentally easiest to use, because it gives at a glance a picture of the lateral and longitudinal attitude of the plane. It is to the pilot as relaxed of much strain, because he has practically nothing to interpret and because he is looking at an object which appears something familiar. The directional gyro, used with the horizon, indicates the deviation from the course. The horizon at present is weak, however, because it gives no action when an airplane goes into an extreme attitude. As long as it is operated within its limits, the system works perfectly. Most pilots consider it most difficult to depend upon the horizon system exclusively, nor should the student turn to use it first. It is most useful as a supplement to the turn-indicator group, and it is so used by many pilots. Some experts in the field, however, favor by the artificial horizon to the exclusion of all other guides. Wiley Post, for example, made his major reference during his record circumnavigation.

The turn-indicator group requires a little more concentration until one becomes accustomed to it. The pilot who has never worked with it a long time has, however, that the pilot can be trained in an act as automatically in following the instruments as in shifting the gears of his car. It has the advantage over the horizon in being effective in every attitude of the plane, any attitude. The turn-indicator is the type of instrument which is most difficult to handle to the average pilot, and it is the one which should be learned first. Although as it may seem, when defer to the reading and interpretation of the turn and bank indicator, turn-indicator instruments themselves are not always easy.

Successful blind flying depends upon inflexible adherence to a

AVIATION

August, 1939

AVIATION

August, 1939

standard method. To interpret the readings of turn and bank indicators in an ordinary turn, whether correctly based on references or simply guessed, is to follow the instructions or their indications during a power spin is by no means simple, and unless a definite system be followed it cannot be done at all.

1-2-3, A-R-C, X-Y-Z

First the turn indicator should be read. That has to do with course, with the right and left deviation of the plane, controlled by the rudder, and in entering normal flight the first aim is to use the rudder to bring the turn indicator to zero. Second, the bank indicator is read. It indicates the longitudinal position of the wings, the attitude controlled by the ailerons, and the altitudes are used to enter the bank in the table, correctly holding the turn indicator still normal. Third, the air speed indicator is observed as an indicator of the position of the plane in relation to the point of take-off. When the deviation is brought into play to keep it to a normal value. Speed above normal cruising speed of course indicates a climb or descent, but not completely independent, and the turn indicator is likely to show that the rudder needs further attention after the altitudes have been used to bring the ball to the center of the bank indicator scale.

This system was worked out by pilots themselves in actual service. Like a counter bridge building system, it has a catholic architectural taste. Blount Shaw, outstanding flying instructor in the Eastern Air Transport, has called the method the 1-2-3, and by that designation it is now widely known. As stated above, it calls for reading: (1) the turn indicator; (2) bank indicator; (3) air speed, and making the necessary corrections as that order.

This holds even if only the third element indicates a correction to be made. The point is that if all are checked over as the 1-2-3 order at the time the procedure will be indicated on a table affixing conditions in a tight spot and avoiding the extreme danger of inadvertently accepting an undesirable velocity by attempts to correct out of turn. Even the most experienced pilot needs a system of some sort. No one can count on learning to read all the instruments at once and correct everything at once by the use of all three controls, particularly if the bag has been blown down by the wind, and the A procedure becomes somewhat and second nature and stops becoming first and last deliberate a glimpse at the instruments is sufficient to get the proper mental and muscular reactions.

It shows that the pilot who tried to make a turn in blind flight, with no means

known. Major Ocker and Lieutenant Crane have diagnosed the same procedure as the A-R-C system, and have shown how they can be used in the X-Y-Z method. The latter is the one as the A.R.C., except that with the rudder movement there is a standard aileron movement of ailerons, and it is based upon the study made of the involuntary turn which is the beginning of the trouble in blind flight. Ocker and Crane teach that the real cause of the involuntary turn is the lowering of the wing and the slight turn which accompanies. That becomes apparent, only in the ordinary turn, but in all of the modern airplanes are subject to directional control largely by the ailerons, the procedure of dipping involuntary turns by the X-Y-Z method strikes at the cause of the difficulty by using rick and rudder together, the ball in the bank indicator is levelled, the ball of the bank indicator is not greatly disturbed, nor does it slip or rotate, vertical is reduced and good right turn is achieved. Of course, in any case, the rudder, which was first brought to zero, must be checked again in the process of recovery procedure, but it is not completely independent, and the turn indicator is likely to show that the rudder needs further attention after the altitudes have been used to bring the ball to the center of the bank indicator scale.

As the airframe turns it

Instrument flying instruction at Eastern Air Transport starts first with the interpretation of the flying instruments. The first aim is to get the pilot to keep out of a dangerous attitude of the plane, and the aviation background should be provided by lateral reference. If it has been learned by experience, the Army course includes a requirement for a cross-country "dead-end" flight, the pilot under the hood having an instructor in the back seat and specifying for the dropping of the bomb when his calculations tell him that he is in a dangerous position.

In the T. W. B. School, the student first acquaints himself with the use of the plane in blind flight. Simple turn, properly banked, followed by precision turns made by the clock. The turn indicators are adjusted to a normal turn can be negotiated by holding the hand of the turn indicator off the zero line by exactly its own width for a period of one minute. The turn is then made at the rate of 30 degrees per second. After doing turns without the compass the student advances to turns with that instrument. Being very careful not to change his direction by a clock or dial. A compass error is likely to follow as much as 10 degrees, though before he

reverts from which the student receives instruction. Graduation from the course calls for satisfactory recovery from spins, power spins, and spins. The Corps Training Center and at a British commercial school specializing in training of a military type the blind-flying curriculum includes all the ordinary maneuvers, loops and rolls and the like. Instructors in the British school claim that Ocker can be made more accurately and consistently from under the hood than in the open, as the pilot then concentrates all his attention on his instruments and has no sight of a revolving horizon.

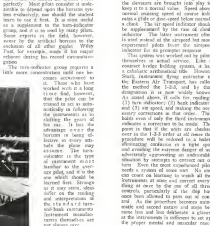
Other companies give formal courses which include navigation as well as use of flying instruments. Transcontinental Airlines, for example, has a course for its pilots, have prescribed training which requires about six and two hours, respectively, to complete and which include nearly nothing on landing the aircraft and something as closely as possible a landing while blind. The latter is a very difficult subject.

Pan American's course of instruction is supplemented by monthly practice periods of an hour or two, and many pilots have been able to make extraordinary use in the manner on their own. United pilots take a two-hour course and go at it at least an hour per month in practice. The training in following a compass course or a radio range and maneuvering into a field while blind is considered an extremely important part of the instruction. It is a privilege in a serious under reduced visibility is limited, and there are many in that category. Bad-weather flying involves many difficulties, and the pilot must keep out of a dangerous attitude of the plane, and the aviation background should be provided by lateral reference. If it has been learned by experience, the Army course includes a requirement for a cross-country "dead-end" flight, the pilot under the hood having an instructor in the back seat and specifying for the dropping of the bomb when his calculations tell him that he is in a dangerous position.

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NAVY instruments are set so that they can be checked at a glance in the emergency. From top: turn indicator, bank indicator, and directional gyro.



EDITORIALS

AVIATION

EDWARD P. WABNER, Editor

Air transport keeps

rolling along

IF one of the basins about the size in the air there is a tale of how the news of the signing of the armistice came up to the front. A pursuit pilot of unblemished reputation and unexaggerated courage heard the report and left into a duel, and went about mulling it in himself. "I've lived through the war! I've bled through the war!"

To have lived through the war was something of an achievement in itself. Merely to have lived through the current economic conflicts, when they shall finally have come to an end, will have been no great accomplishment. There will be business men who will look back upon their own history, when smooth seas and sunny skies return, and say with a touch of awe: "We've lived through the depression!"

It is no easy matter to stay alive. It is much more difficult to make progress. The current economic scene is like the wind when the Red Cross took Africa while one must keep running at top speed to stay in the same place and much faster than that to make it get anywhere. Air transport has qualified for the very small and select group of industries that have found it possible not only to hold their own but to get ground.

It is worth dwelling almost indefinitely upon that fact. American air transport operations did more business in 1930 than in 1929—more in 1931 than in 1930,—more in 1932 than in 1931. Or how many other industries can that be said? Count them up. No matter how carefully you take the field, you will hardly need the fingers of both hands for the purpose. The list of industries that have made steady progress during these years of worldwide travail and tragedy is even more exclusive than that floundering list of billion-dollar corporations in 1929 and air transport stands upon the list.

This issue of AVIATION is a special salute to the importance of the transport factor in aviation. It appears upon our twentieth anniversary. Airplane manufacturing was stimulated, was already a great and rapidly growing business before Aviation had completed its first

year. Air transport was its infancy. This year, for the first time in history, transport stands out as the most considerable of all aeronautical activities. For the first time, the receipts of air transport companies will exceed the total volume of sales of airplanes and engines, military and commercial. Furthermore, this year promises to be the first in which the purely commercial revenues of air transport, entirely independent of any governmental support of the air mail, exceed the commercial sales of airplanes. This is a good thing at which to stop and make some expression of our admiration of a great industrial achievement.

No longer must American enthusiasts look to Europe for evidence of what can be done. The volume of passenger traffic on American airlines this year will be 50 per cent larger than for those of all Europe combined. No longer is there even a shadow of excuse for the Americans who have made it a practice to fly when on vacation trips abroad but never at home. They can be carried in their own country more swiftly and safely than anywhere else in the world, and quite as economically and comfortably. Facts and figures prove it.

No longer is it possible to consider air transport as an outgrowth of gray flying, run by irresponsible owner-birds. Once upon a time there was some trace of that, but today the business is a part of the nation's transport system, and it pays as good a return upon careful and progressive management, as does manufacturing or shipping. The public appreciates the high standards that have been set, and the public responds. The total air mail appropriation for the fiscal year just starting is only 2 per cent below that for last year, in spite of cuts in other governmental expenditures that have run to between 5 and 15 per cent in almost every instance. This air mail appropriation was not saved by any lobbying or the plots of any special interest, but by the very plain demonstration that Congress received of the general public's confidence in the service and interest in maintaining it as least as its present standard.

In the transport number of AVIATION there is plenty of evidence of the progress that has been made, and plenty of reason to look forward to its continuance. To select but a couple of points for mention, upon pages 344 to 347 is a tabulation of a personnel transferring over 6,000 men and women, and an equipment totaling over 600 planes, more than half of them equipped with two-way radio. The figures represent an investment, taking into account only equipment which is actually used and only at its replacement cost, at some fifty million dollars, and they handle a gross revenue of more than thirty million dollars a year. Upon page 366 is a description of new equipment upon which some two million dollars more is to be expended in anticipation of next year's business.

Beginning on page 328 we present the views of air transport's leading executives upon questions affecting air transport's future. They breathe a solid confidence. Reading them, no one can doubt that confidence is justified, or fail to share it.

NEWS OF THE MONTH

Traffic increases

MORE passengers were carried on American airlines during the first six months of 1932 than during the first six months of last year, despite the general business conditions which have made recovery of traffic slower in the order of the day in other transport industries. Additions to schedules and improvements in organization are the answer of airlines to the traffic demand for air transportation. Celebrating the completion of six years of air mail service and three years of passenger passenger service between New York and Boston, American Airways recently added two round trips daily to the previous schedule. Eight planes are now flown daily in each direction, the first leaving Newark at 3:15 p.m. and Boston at 7:15 a.m. The addition of an afternoon plane at 3:15 p.m. on the New York-Albany, Syracuse, Rochester and Buffalo line gives this city daily round-trip service for the first time. General operations and traffic improvements of American Airways are being transferred from New York to LaGuardia field in St. Louis. The offices of Captain T. C. Cullen, president of both American Airways and American Corporation, will remain in New York as will the controller and treasurer.

New and additional schedules are especially numerous on the northern and western routes of United Air Lines. The inauguration of another direct air schedule from Spokane to Salt Lake, where connection is made with the transcontinental route, and an extra shuttle service between Spokane and Portland, give the Idaho Empire two daily air connections with the East Coast as well as the first regular service between Spokane and Portland. Speed on these routes has been increased to give a 24-hour schedule between Chicago and Seattle. It only remains the question of Washington being a direct service on a "western" transcontinental route. Time on the Kansas City-New York route has been cut to ten and a half hours, of daily. Arrangements with El Al and Air Lines enable passengers from Minneapolis and St. Paul to change to United at Sioux City, only a short run from Omaha and United's route to coast connections.

New air-line connections

Air transport facilities were made available to twenty Middle Western communities by recent inter-airline traffic agreements between Transcon-

tinental and the Great Lakes and Eastern Michigan Airways. The new air-line system, established under eighteen other which are parts of old of Transcontinental planes, the traffic arrangements made by Transcontinental and Western Air and Eastern Air Transport, enables each company to act as agent for the others. Air reservations can be made at any last station.

Arrangements for connection between planes of Transcontinental and Western Air and Eastern Airways at St. Louis give a new air and passenger service between Chicago and Tulsa, cutting a full hour from the latest routing schedule. This route leaving Tulsa at 8 a.m. arrives at Chicago at 1:00 p.m., while the south-bound schedule, slightly slower because of prevailing winds, provides for departure from Chicago at 10:30 a.m. and arrival at Tulsa at 4:25 p.m.

The first co-ordination of airplane and customs inspection service is being made by the United Airways recently started in concert. New Bedford and Woods Hole with Plymouth Island and Nantucket, and Cape Cod, Bermuda connections, planned with 300-day Wright Whitehills and equipped with gasoline, push four round trips daily in each direction on a 46-minute schedule. This coincides with the New York boat of the New England Steaming Com-

pany, whose docking and other facilities are used, and with Boston travel at Woods Hole.

Boston and Springfield, Massachusetts, are now linked by air. The Travel Air 800s of State City Airways, Inc., make three round trips daily, speed bus service from the South Station in Boston to the Municipal airport ending the 17-minute one-way trip, and allow to one hour and fifteen minutes.

Several new services, replacing some that were temporarily discontinued after the consolidation of Canadian air mail contracts last winter, have been inaugurated by Canadian Airways. Ltd. Between Calgary and Edmonton, the two chief cities of Alberta, two flights are made daily in each direction with passengers and express. A daily passenger and express service between Toronto and Windsor, with intermediate stops at Hamilton, Brantford and London, gives Toronto a five-hour connection with Chicago and intermediate connections with Winnipeg. A 90-minute Quebec-Montreal service connects with the Montreal-New York plane operated by Canadian Colonial.

Pan American's Arctic project

Pan American Airways, which last spring arranged for joint expedition of the sub-Arctic air route to Europe first investigated by Transcontinental Airlines Corporation during 1921 (AVIATION, May, 1922) recently announced the completion and other operating agreements previously proposed along the northern route. The government of Iceland has agreed to the transfer of the 72-year connection which it granted to Transcontinental last March. Permitted operations over Iceland, the company to operate Pan American's exclusive use of the route from Detroit to Copenhagen, to London, to Greenland and Iceland, for three years.

Pan American's 44-passenger Clippers, which have been carrying 3,800 passengers a month between Miami and Havana since last November, have been transferred to their original run across the Caribbean Sea. They now fly one of the two weekly schedules between Miami, Kingston, Jamaica and Barranquilla, Colombia, over the route on which the flagships, American Clippers, made their maiden flight. On the first trip under the new arrangements, beginning June 13, several round-trip runs between Miami and Barranquilla and several other South American cities were offered at one-way fare plus \$1

Calendar

Date	Event
July 18	Pan American Airways, Inc. (Miami, Fla.)
Aug. 14-18	International Flying Contest, Long Beach, Calif.
Aug. 18-19	International Flying Contest, Long Beach, Calif.
Aug. 19-21	International Flying Contest, Long Beach, Calif.
Aug. 21-23	International Flying Contest, Long Beach, Calif.
Aug. 23-25	International Flying Contest, Long Beach, Calif.
Aug. 25-27	International Flying Contest, Long Beach, Calif.
Aug. 27-29	International Flying Contest, Long Beach, Calif.
Aug. 29-31	International Flying Contest, Long Beach, Calif.
Sept. 1-3	International Flying Contest, Long Beach, Calif.
Sept. 3-5	International Flying Contest, Long Beach, Calif.
Sept. 5-7	International Flying Contest, Long Beach, Calif.
Sept. 7-9	International Flying Contest, Long Beach, Calif.
Sept. 9-11	International Flying Contest, Long Beach, Calif.
Sept. 11-13	International Flying Contest, Long Beach, Calif.
Sept. 13-15	International Flying Contest, Long Beach, Calif.
Sept. 15-17	International Flying Contest, Long Beach, Calif.
Sept. 17-19	International Flying Contest, Long Beach, Calif.
Sept. 19-21	International Flying Contest, Long Beach, Calif.
Sept. 21-23	International Flying Contest, Long Beach, Calif.
Sept. 23-25	International Flying Contest, Long Beach, Calif.
Sept. 25-27	International Flying Contest, Long Beach, Calif.
Sept. 27-29	International Flying Contest, Long Beach, Calif.
Sept. 29-31	International Flying Contest, Long Beach, Calif.
Oct. 1-3	International Flying Contest, Long Beach, Calif.
Oct. 3-5	International Flying Contest, Long Beach, Calif.
Oct. 5-7	International Flying Contest, Long Beach, Calif.
Oct. 7-9	International Flying Contest, Long Beach, Calif.
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MAJOR AIR TRAFFIC ROUTES—Pan American Constellation aircraft—shown in flight in commercial service. Mail express air service also is available and express delivery of this service made by Airway.

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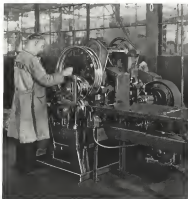
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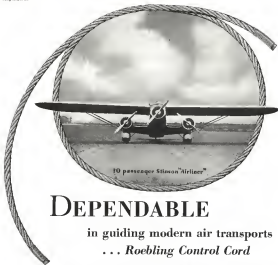
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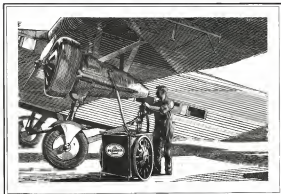
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